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Localised non-migmatitic UHT domains within thermally buffered migmatites

SAMANTHA NICOLE MARCH[1], MARTIN HAND[2], LAURA JANE MORRISSEY[3] AND DAVID KELSEY[4]

[1]The University of Adelaide
[2]University of Adelaide
[3]The University of South Australia
[4]Geological Survey of Western Australia

Presenting Author: samantha.march@adelaide.edu.au

The maximum temperature reached by rocks during regional metamorphism is primarily dependent on a combination of lithology, depth of burial, and energy from regional heat flow. Ultrahigh-temperature (UHT) metamorphism requires a substantial conversion of this energy to temperature. However, crustal anatexis is an endothermic process that may also consume significant quantities of energy. Therefore, it is well-recognised that fertile lithologies prone to melting may record lower temperatures relative to more refractory rock types in the same heat flow environment [1]. Potentially, a natural case study for this phenomenon exists in the Warumpi Province in central Australia. Pressure–temperature (*P–T*) modelling of migmatitic and non-migmatitic metapelites in close proximity shows they attained different temperatures during medium-pressure Mesoproterozoic (*c.* 1150 Ma) metamorphism. The migmatitic metapelites record temperatures of around 820 °C, whereas metapelites that show no evidence of melting, record temperatures of 890–940 °C. Pre-metamorphic alteration created ~ 1 km scale refractory bulk compositions, allowing temperature rise to be unbuffered by the melting processes that dominated the enclosing metapelites. This resulted in the formation of localised domains of UHT rocks contained within lower temperature granulites.

[1] Schorn, Diener, Powell & Stüwe, K., (2018). *Geology*, *46*, 643-646.